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Evolution of Artificial Intelligence Research in Human Resources

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Abstract

The objective of the article is to investigate the evolution of the application of Artificial Intelligence (AI) in the area of Human Resources (HR). It presents a panorama of the research that used AI in the area of HR, through the quantitative descriptive analysis of journals and proceedings, registered in the base of the Library of Online Knowledge (B-on), in the period between the years of 2000 and 2018. 32 research publications have been identified that address the application of Artificial Intelligence in the Human Resources area. As a didactic support and aiming to facilitate the understanding of the analysis, the period of the 18 years studied was divided into 3 time periods (First decade, Reduction Period and Period of Growth). The study also raised the distribution of AI application in HR topics and the incidence in each of these themes. As a result, it was concluded that there are few researches on AI applied to Human Resources and a dispersed use behaviour. It is expected that the 9 inferences about the results mentioned in this essay will elicit future studies.

Keywords: AI in HR; Human Resources Management; Human Resources Artificial Intelligence; ANN in HR; B-on.

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1. Introduction

The increasingly fierce market behaviour requires organizations to optimize and automate processes, leaner teams, in addition to the focus and extreme attention of all the stakeholders in the business, in search of the much-desired competitive differential or even to guarantee its simple survival. In this context, two elements are fundamental: the implementation and use of advanced management technologies and the attraction and retention of the best talent. Technology is the set of tools that will facilitate the optimization of processes, and human talent is what will ensure that new solutions are given, that the plans are well executed and monitored for organizational performance jumps. Thus, the interest in understanding better how the relationship between technologies and human resources has been legitimized.

Artificial Intelligence began as a field of research in the 1950s, seeking to understand the nature of intelligence in living organisms, specifically of the humans [1]. The growth of the information volume in the databases, found in many practical problems of optimization, has stimulated the study and application of alternative techniques in the search of methods that can reach good solutions, such as, to conjugate concepts of Optimization and Artificial Intelligence [2].

Recently, much attention has been given to the machine learning, probably due to the innumerable possibilities of automation brought by recent advances in Artificial Intelligence [3]. In addition, it is expected that the impact of Artificial Intelligence progress will go beyond changing the nature of work, causing changes in economic mechanisms and business models, which will potentially bring impacts to management [4].

As for the human resources sector, this has been one of the most impacted by new trends and is undergoing a major transformation in repositioning terms and their new role within companies. Human Resource Management (HRM) has become a strategic trend in organizations [5]. HRM has been evolving, driven by economic, political, social and mainly technological transformations, as well as by the demands of competitiveness and operational excellence [2].

It is important to understand that Human Resources Management (HRM) strategy is concerned with employment policies and practices, which encompasses recruitment, selection, evaluation, development and retention of employees, as well as recruitment, consultation and negotiation with individuals [6].

The integration of human resources and business strategies is constituted by representation of HRM's at the organization's high level of decision-making [7]. Therefore, the greater the credibility of information, the more assertive the decision-making will be. In this context, AI comes as a system of extreme importance, acting as a supporter and leveraging the effectiveness of the Human Resources (HR) area.

Thus, it is important to investigate the evolution of the application of Artificial Intelligence in Human Resources to understand how the evolution of researchers' interest in has been applying the AI in HR. This investigation of research interest is made by identifying evolution of the number of publications of the tool, which type of IA has been most used and how it has been applied in this sector of administration, so important for the good functioning of organizations, such as HR.

Because it is a relatively recent field of research, it is of vital importance for the academy to evaluate what has already been produced and to assist future research on the contributions of technology applied to HRM.

2. Methodology

The present work used the quantitative and descriptive method to measure the evolution of the application of artificial intelligence in the area of human resources. In this methodology, the conclusions take into account the set of variables that may be correlated with the object of the investigation [8].

The collection of data and information was made, using the Online Knowledge Library (B-on) website, listing four types of search, associating keywords and terms (Neural network or ANN and Human resources; artificial intelligence or AI or A.I. and Human Resources; artificial intelligence or AI or A.I. and recruitment and selection; artificial intelligence or AI or A.I. and recruitment).

The keyword search has selected the filter "SU - Subject Terms", in the period between 2000 and 2018, in the English language, with contents of academic and scientific journals and materials presented at conferences.

In order to make the discussion clearer, the period was divided into 3 temporal milestones in the application of Artificial Intelligence in HR: The first period (2000-2010), here called "First decade"; term period (2011-2017), called in this paper " Reduction Period" and the third period (started in 2018), here called "Period of Growth".

3. Analysis

As a result of the research, 32 publications were found. Of the total, 23 publications are of the type "Neural network or ANN and Human resources", using several types of Artificial Neural Network (ANN), among them Fuzzy, Radial Basis Function, Elman and Feed-Forward. The others 05 are of the type "artificial intelligence or AI or A.I. and Human Resources"; 03 of type "artificial intelligence or AI or A.I. and recruitment" and just 01 of type "artificial intelligence or AI or A.I. and recruitment and selection. Thus, 71.8% of the publications investigated are applied in the use of the artificial neural network in human resources.

In this sampling, the application of the artificial intelligence tool is distributed with different objectives in the area of human resources. In this period, the tool is applied as a supporter of issues related to Management, Team Estimate, Recruitment and Selection (R&S), Employability involving Recruitment and Selection, Recruitment (step that precedes the selection - a set of procedures for attracting candidates from a range of curriculum offerings, following job/function criteria), Turnover, Corporate Education/Trainings, HR Performance Measurement, Development (HRD), Quality of life at work, Employability and Management by competencies.

Of the themes mentioned above, three application items stand out. The first highlight is in the application of AI focused on Management, corresponding to 25% of the subjects in the sample. The second place in the ranking is in the application for Team Estimate, totalling 15.62%. The thirdly is the application in Recruitment and Selection was emphasized, which corresponded to the 12.5% of the sample studied. According to table 1, below.

Table 1. Distribution of the AI application of HR topics during the years (2000-2018).

Application in HR	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
Management								1		1	3			1		1		1	
Team Estimate						1			1	1				1		1			
Recruitment & Selection		1																	3
Employability/R&S				1						1									1
Recruitment																			2
Turnover									1										1
HR Performance Measurement							1						1						
Corporate Education /training									1			1							
Development (HRD)									1										
Management by Competencies					1														
Quality of life at work															1				
Employability																		1	

Regarding the time factor, were observed the growth in interest in researching the theme from 2000 to 2010, as it can be seen in Fig. 1. It can be said that this growth accompanies the evolution of research on the subject of artificial intelligence in different areas of activity, be it in the area of human resources or in different areas of its application, such as engineering, medicine and others.
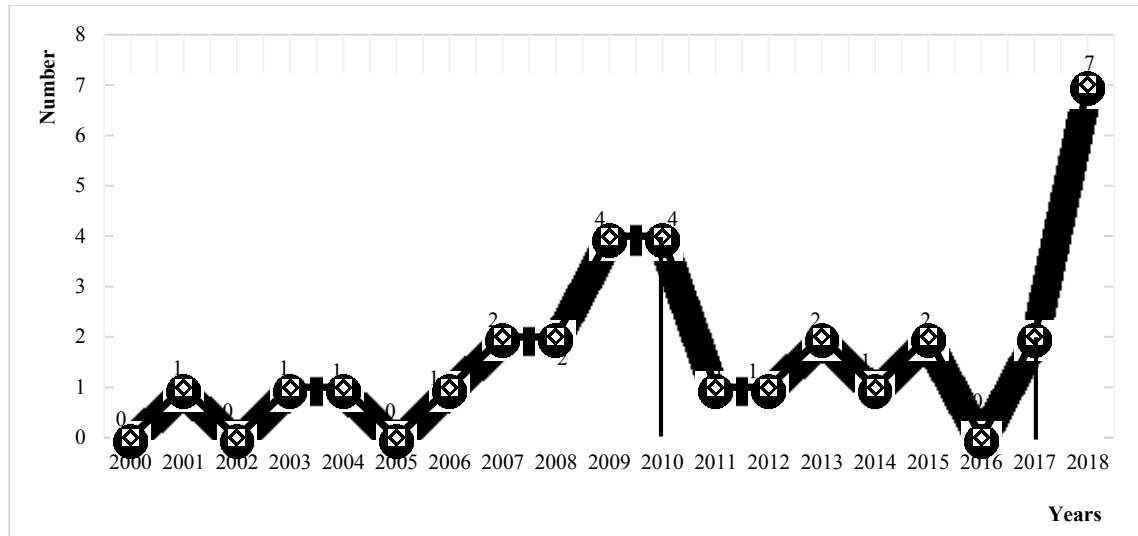
Fig 1. Number of Artificial Intelligence publications applied to Human Resources in B-on.

This methodological application identifies in this "First Decade", that is, between 2000 and 2010, one publication in the year 2001 with Recurrent ANN (RNN) AI, applied in HR, "A neural network modelling on human resource talent selection" [9] corroborates the role of AI in R&S as a decision support system.

In this same period, other articles elucidate the RNN-type AI applied to HR, but with a focus on management, among them "A HRD Evaluation Method Based on BP Neural Network" [10] "Enterprise Human Resource Management Outsourcing Decision-Making Model Based on BP Neural Network" [11] and "The Study of Enterprise Human Resource Evaluation Research Based on Neural Network" [12].

The largest number of publications occurs in 2009 and 2010. In 2010, 75% of the investigations are applied in HR management, that is, using AI to support decision-making.

However, between the years 2011 to 2017, denominated in this study "Period of Reduction", there is a decrease in the works of IA in the area of HR. This leads to questioning the possible causes that led to this reduction. In this context, about 33.3% of AI research in HR focuses on the management theme.

In addition, 22.2% are applied for the estimation of the teams, i.e. support to the size of the number of workers for companies. Some featured publications at this stage are "The research on the university human resources risk management based on RBF neural network" [13] and "Research on human resource intelligence system based on knowledge" [14] with AI applied to HR management.

Another point observed, that need analysis, is the fact that, in 2018 there is a sudden increase in interest in researching the subject. This "Growth Period" is verified by the number of publications (7 of the total of 32) during those 18 years, representing 21.8% of the total research. In addition, no previous year recorded more than 4 publications in the same time frame. It is also important to understand how this automation and the advancement of AI has influenced this shift in the landscape of interest in HR research. In this last period, 71.4% of the researches were applied to the topics of recruitment and selection, activities involving attraction and more adequate choice of workers, as a support system for companies. The paper "Applying artificial intelligence: implications for recruitment" [15] describes technological advances in AI and that its application has the role of creating value for the recruitment industry as well as value for clients. And the paper "Making Better Job Hiring Decisions using "Human in the Loop" Techniques" [16] reinforces understanding by stating that firms have the perception that hiring the best employees produces competitive advantage, which is hardly replicated by competitors. Therefore, AI systems applied to R&S are able to save time and money in the recruitment process. The other publications are represented in 14.3% of the application is in the Turnover theme and 14.3% in subjects related to employability, related to the ability to obtain and/or maintain the employee's employment.

Table 2. Inferences about the result.

No.	Inferences
1.	The growth in the first decade (2000-2010) was promoted by the period of increase of studies of Artificial Intelligence, generating interest in researching it for different purposes, including in HR.
2.	Low results in the application of AI in HR during the first decade would have caused disinterest and/or discontinuity in the research (gap).
3.	The lack of consolidation of lines of research discouraged the development of new research.
4.	Political locks and/or country rules, preventing greater participation or continuity in the surveys.
5.	Slowdown in the interest in academic research, not corresponding to the development of solutions in organizations. AI systems being developed and customized within large companies, by their workers, without disclosure in the academy.
6.	The absence of solid research lines up to the present moment would be justified by the fact that most research is done exclusively in the area of engineering by professionals of this nature, with little involvement of human resources researchers and technicians.
7.	The creation of multidisciplinary teams, including engineering professionals and human resources technicians, will contribute to the evolution, creation of research line and strengthening of the study group, using AI in HR.
8.	The innumerable possibilities of automation brought by recent advances in Artificial Intelligence are the promoters of this new beginning, in 2018, in the interest in applying the tool in HR.
9.	Most of the studies of 2018, period of recovery and growth, applied to recruitment and selection, due to the new demands in the organizations, which has been fomenting new studies.

4. Conclusion

Daily advances in technology are present and the insertion of new ways to make daily life easier. This is in line with the market scenario that urges and exalts day-to-day practices of process management and people management that seek to make the organization economically viable and stand out from the competition.

Faced with this reality, as a theoretical contribution, this article advances in research on the evolution of Artificial Intelligence in the Human Resources area. The papers and proceedings analysed in the present study show variations in the behaviour of interest in researching the theme, being developed by different authors and in different universities and research centres. The motivations, objectives, methods, AI techniques and HR applications are also varied.

This dispersed behaviour, supports admitting about the possible non-existence of a group, a solid school of thought to be followed. The justification is because within the sample there is a group of authors with several publications in the subject.

In addition, the number of academic researches also undergo radical changes in time. The first decade points to a gradual growth, accompanying the growth of AI in the academic field in general. However, the next seven years of research do not contribute to the progress of the topic nor do they demonstrate the evolution of research lines or groups of authors. Then there is rapid growth, at the end of the sample period, which shows a resumption in interest in the subject.

It is believed that the interdisciplinary practice between AI and HR has not yet promoted a theoretical break or created a new conceptual field. This leads to the conclusion that the involvement of technical researchers and HR specialists and the creation of multidisciplinary teams, i.e., engineers and HR professionals, can strengthen this construction. Due to the fact that the investigations found were elaborated exclusively by authors of the engineering area.

Finally, it is necessary to expand the research, in the sense of complementing, identifying the causes of the behaviour reduction of research and the more concrete establishment of lines of study in the area in question. As limiting factors, it is highlighted that the quantitative study did not take into account qualitative analysis of possible causes of the reduction of research interest in the determined period.

For future study suggestions, it is possible to list: continue to investigate, qualitatively analysing the results of the period 2000 to 2010 in order to raise the causes and possible relationship with slowing in the later period. Moreover, to expand the possibilities of scientific production, investigating what were the demands that caused the increase and necessity of research of AI in HR, applied to the R&S, as verified in 2018. In addition, understand what contributions the theme can promote for the future of organizations.

Acknowledgements

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